The Potential Role of the GPM in Activities at the Naval Research Laboratory

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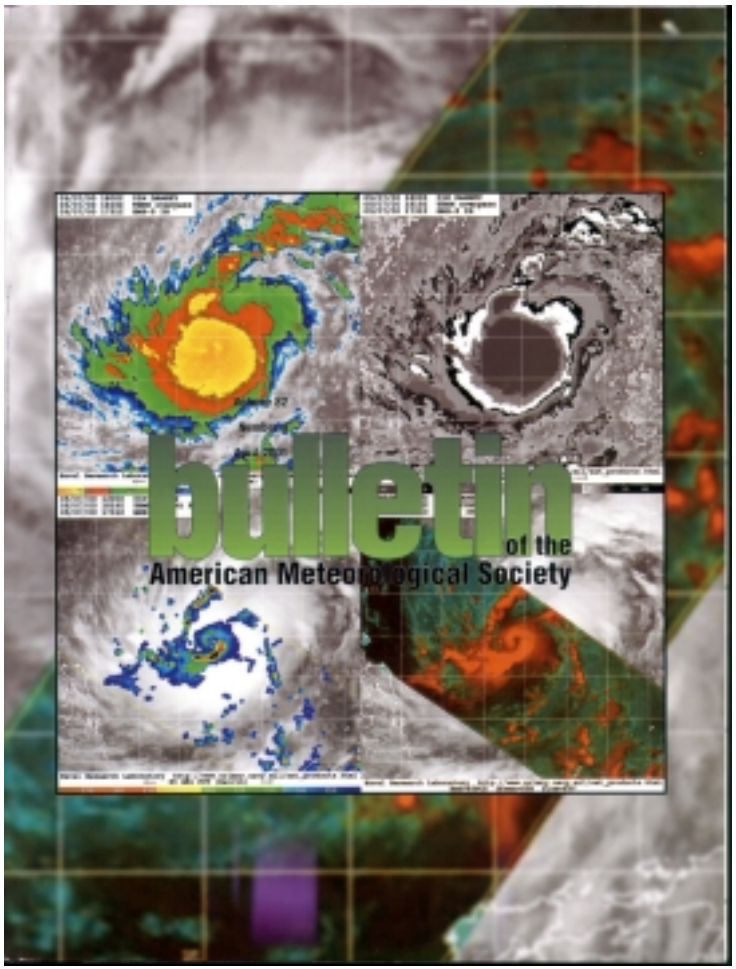


GPM Planning Workshop
UMUC Conference Center
May 16-18, 2001

Research Activities at the Marine Meteorology Division (MMD)

Numerical Weather Prediction

- Global spectral model - NOGAPS
- Regional, relocatable coupled ocean-atmosphere models
- Advanced data assimilation strategies

Meteorological Satellite Data Applications

- Near real-time, global environment for “on-scene” and nowcasting systems
- NRL is a “development ground” for eventual transitions of applications to an operational status

Looking at the GPM from the NRL Perspective

- Environmental Data Records (EDR) from the Special Sensor Microwave Imager (SSM/I) program since 1987 (SSMI/S and WindSat are the upcoming follow-on missions)

- Requirements have shifted to a more regional scale anywhere on the globe (geostationary perspective)

- NRL has focused on complementary geostationary and microwave-based applications (increasingly, NWP model data)

- More frequent updates of microwave-based data would find use in nowcasting applications and model assimilation techniques

Use of TRMM Near Real-Time Data

- NRL-developed Automated Tropical Cyclone Forecasting (ATCF) system used to drive an automated WWW dissemination of all new and active tropical storms (archive since 1998)

- TRMM near-real time data is in routine usage at the Joint Typhoon Warning Center (JTWC) since early 1999

- TMI enhances existing geostationary VIS/IR, SSM/I and scatterometer observations and has significantly improved the estimation and tracking of tropical cyclone intensity

- Higher-resolution imagery, rain and wind speed are important

- Blending geostationary and low-Earth orbiting microwave data

Tropical Cyclone Web Page

http://kauai.nrlmry.navy.mil/tc-bin/tc_home

2001 Storms

All Active Year

Atlantic

East Pacific

Central Pacific

West Pacific

Indian Ocean

Southern Hemisphere

- 92S.INVEST
- 91S.INVEST
- 90S.INVEST
- 06S.CHARLY

Disclaimer

NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page

Development Team

Display: Latest | Warn: Text Track ATCF | 1_km: Track&Image VIS IR Scatt | Info: General

SSMI Sectors:	VIS	IR	IR-BD	Multi-Sensor	85GHz-H	85GHz-H weak	PCT	Color	Rain	Wind	SSM/I Vapor			
TMI Sectors:	VIS	IR	IR-BD	Multi-Sensor	85Ghz-H	85Ghz-V	PCT	Color 85	Rain	Wind	Color 37	37GHz-V	37GHz-H	Liquid Water

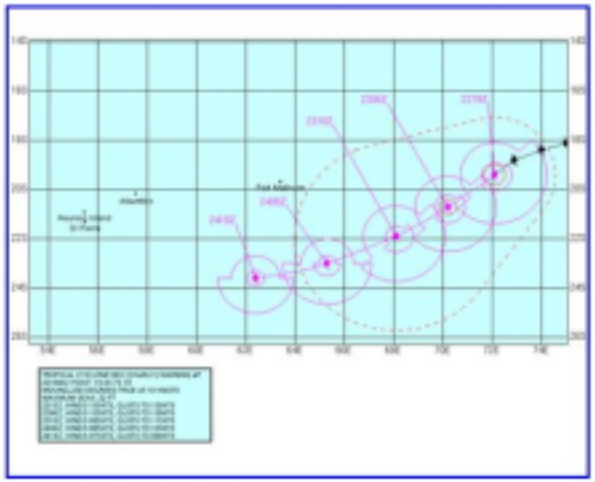
Latest	Upcoming Passes(more)	Current Time
SSMI: 01/22 1527Z	/01/23 01:52 quik 887.8	22:49:57 GMT
TRMM: 01/22 1903Z	/01/23 04:56 F-15 757.8	

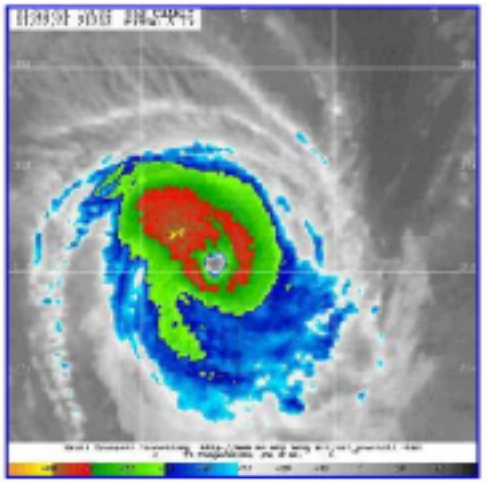
06S.CHARLY

Forecast by Joint Typhoon Warning Center/Naval Pacific Meteorology and Oceanography Center

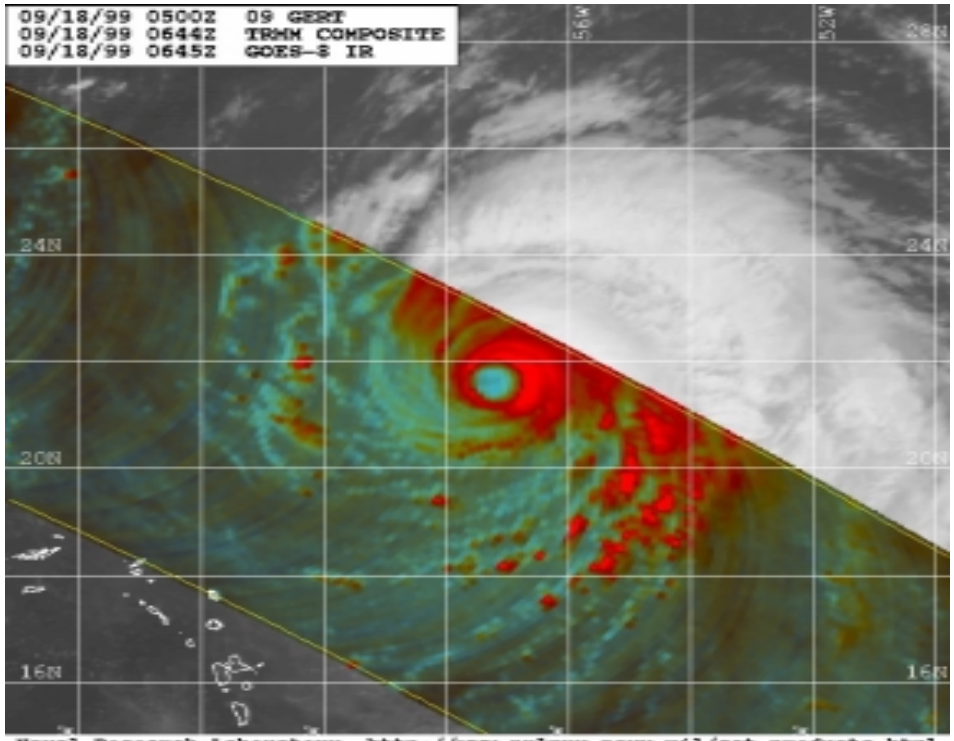
Graphic by Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center

1KM





(Click product for full sized image 19875 Bytes and 180707 Bytes.)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09/18/99 0644Z TRMM COMPOSITE
09/18/99 0645Z GOES-8 IR
28N
24N
20N
16N
56W
52W
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
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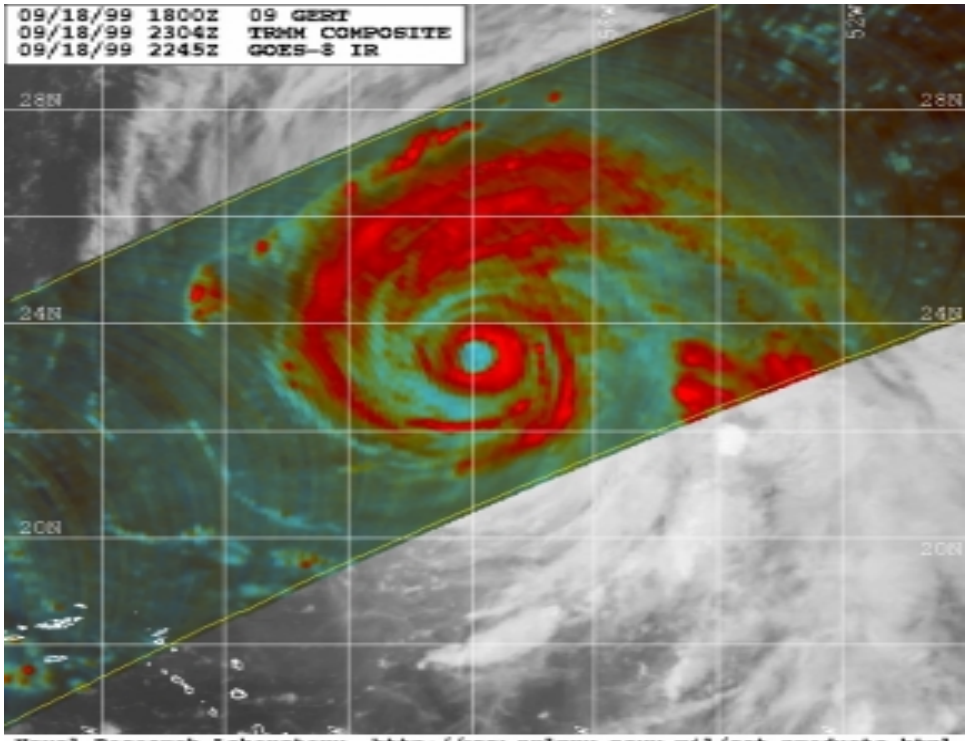
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09/18/99 2304Z TRMM COMPOSITE
09/18/99 2245Z GOES-8 IR
28N
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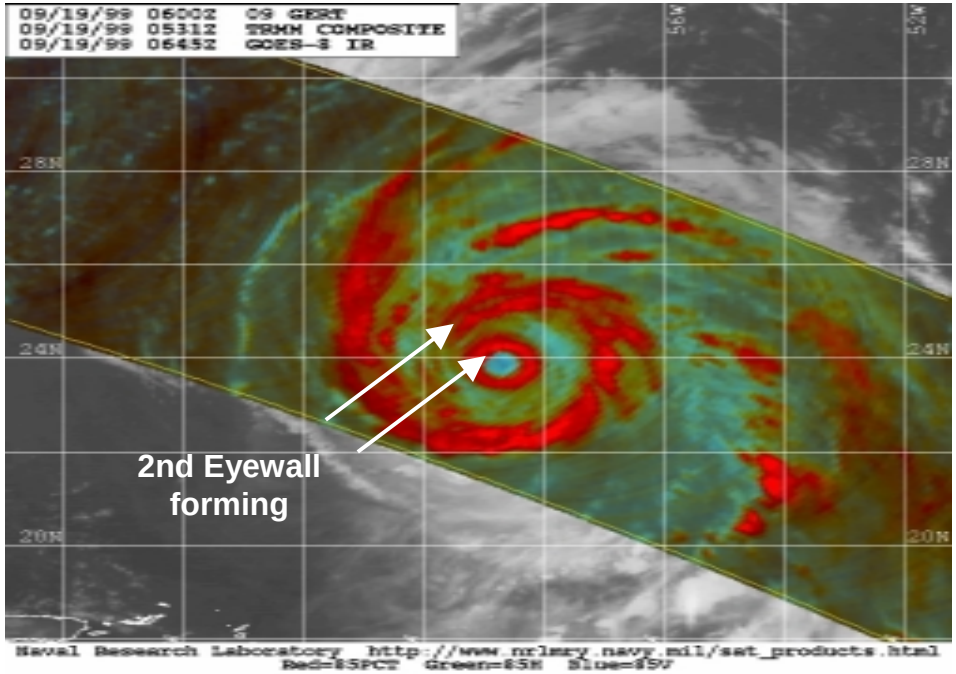
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
Red=85PCT Green=85H Blue=85V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09/19/99 0531Z TRMM COMPOSITE
09/19/99 0645Z GOES-8 IR
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forming
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
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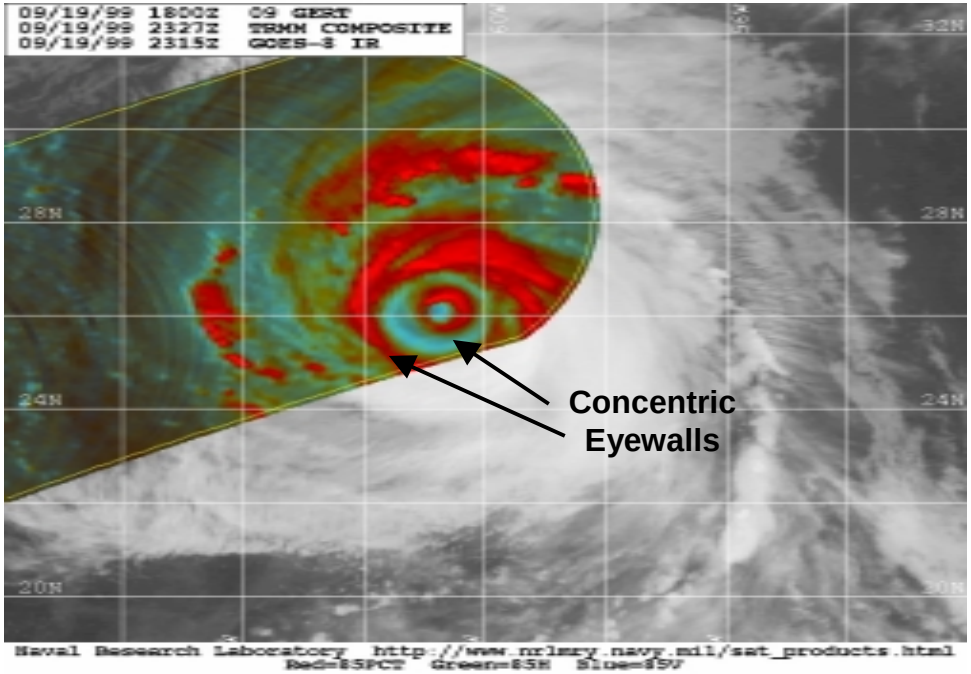
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09/19/99 2327Z TRMM COMPOSITE
09/19/99 2315Z GOES-8 IR
28N
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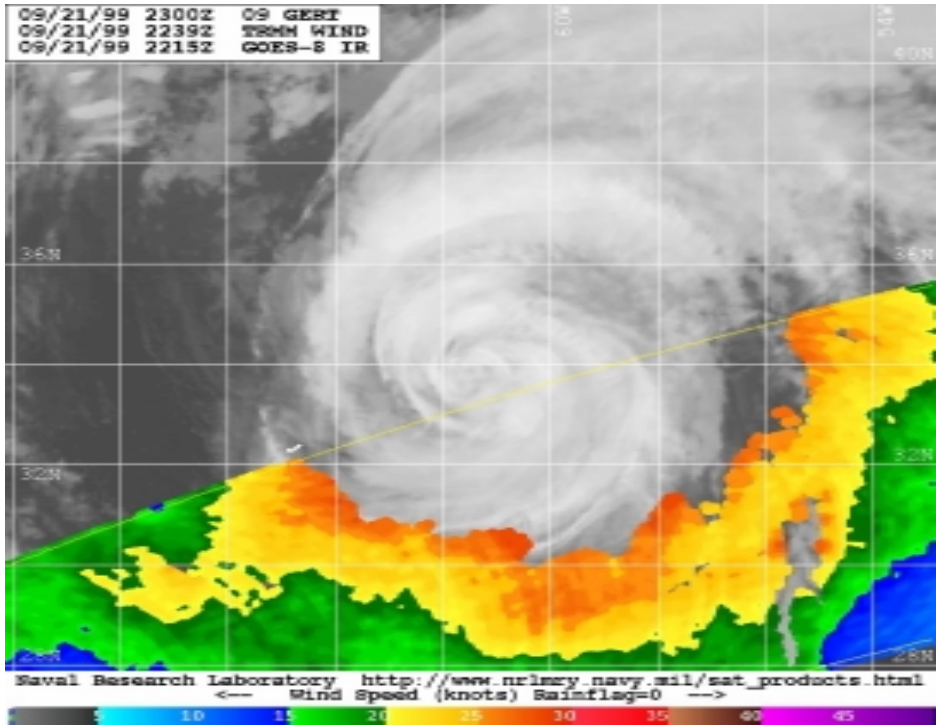
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
Red=85PCT Green=85H Blue=85V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09/21/99 2239Z TRMM WIND
09/21/99 2215Z GOES-8 IR
36N
32N
28N
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
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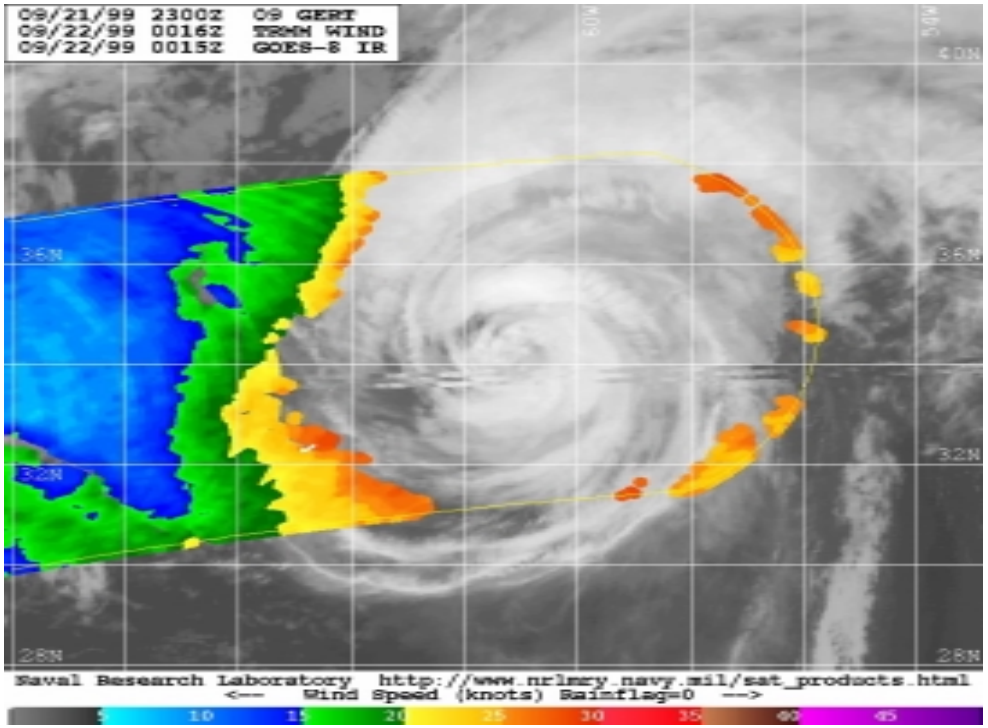
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09/22/99 0016Z TRMM WIND
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36N
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28N
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
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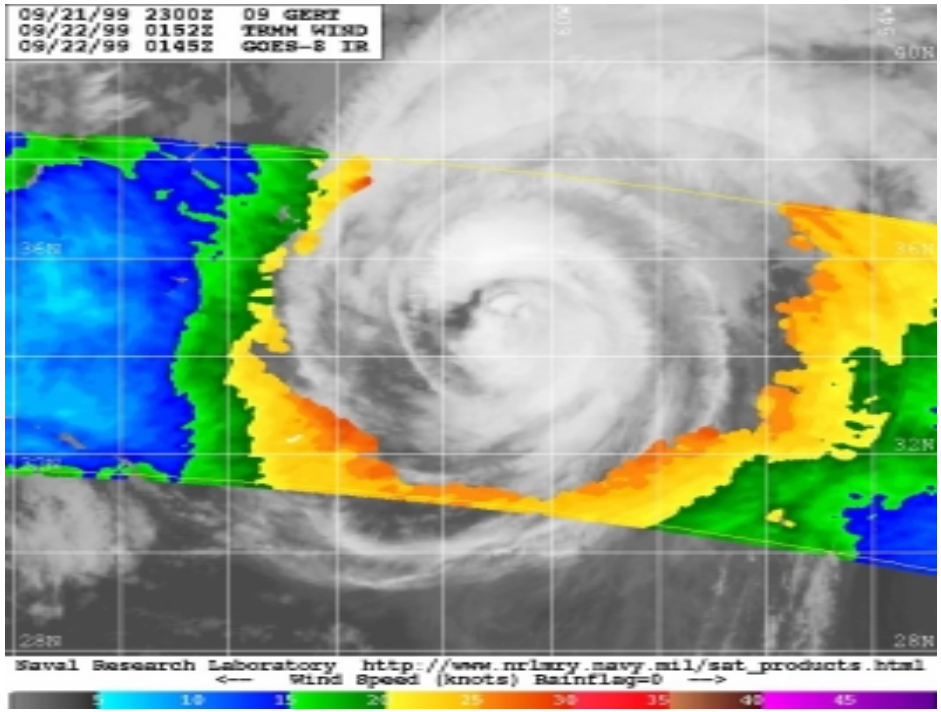
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09/22/99 0152Z TRMM WIND
09/22/99 0145Z GOES-8 IR
36N
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28N
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
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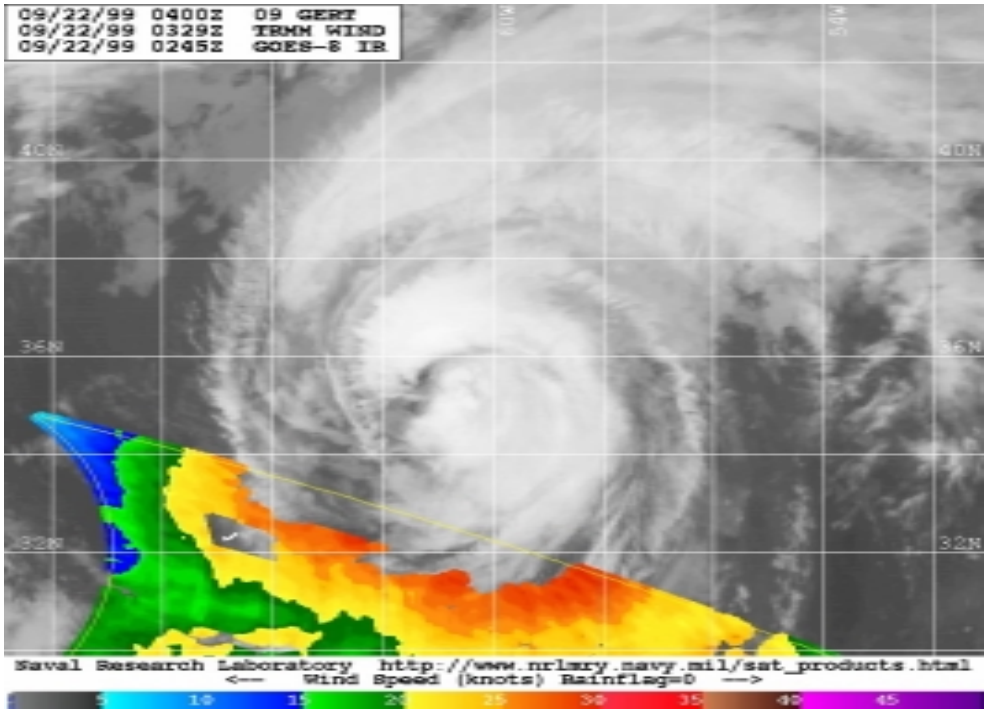
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09/22/99 0329Z TRMM WIND
09/22/99 0245Z GOES-8 IR
40N
36N
32N
Naval Research Laboratory http://www.nrlmry.navy.mil/sat_products.html
<--- Wind Speed (knots) Rainflag=0 --->
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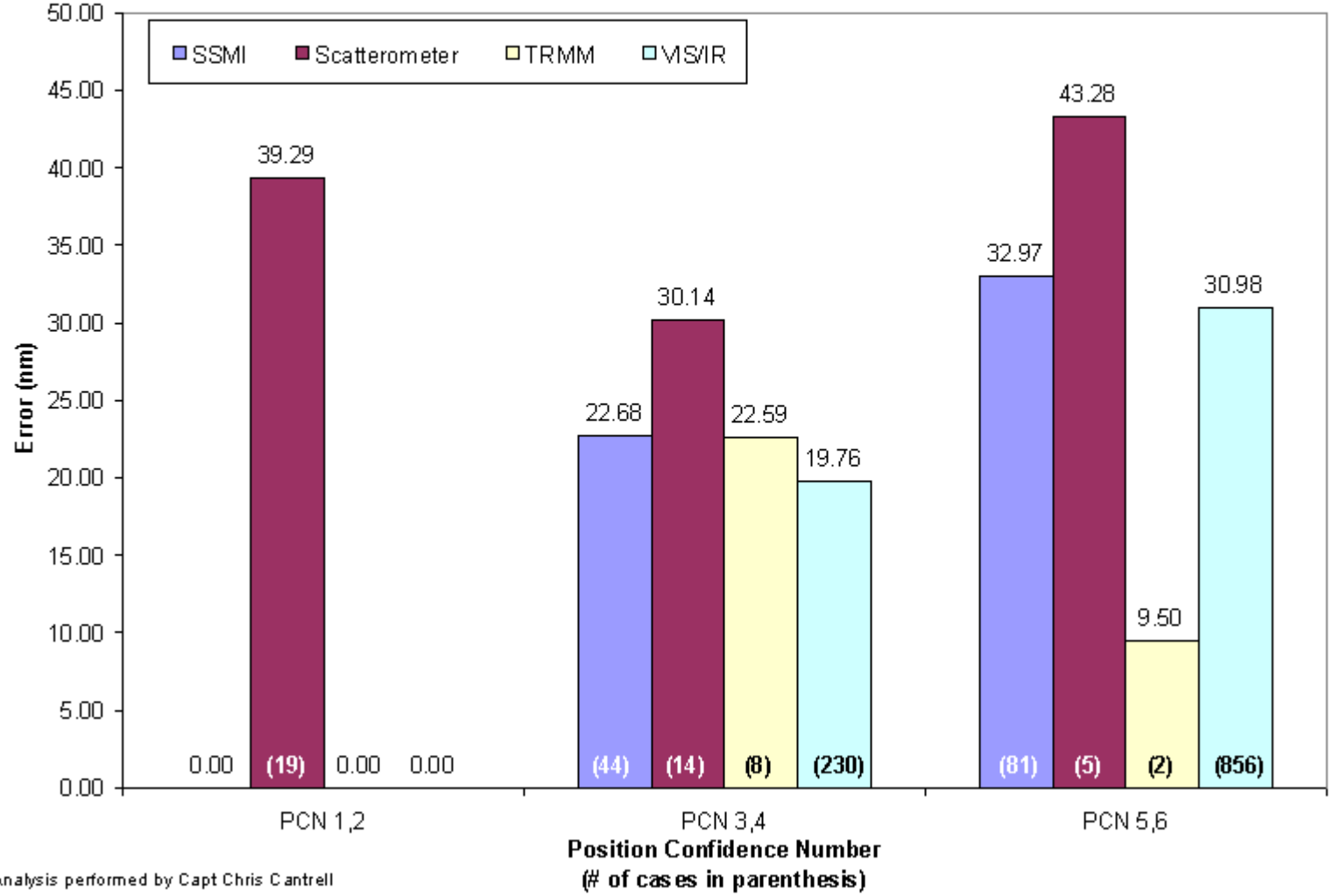
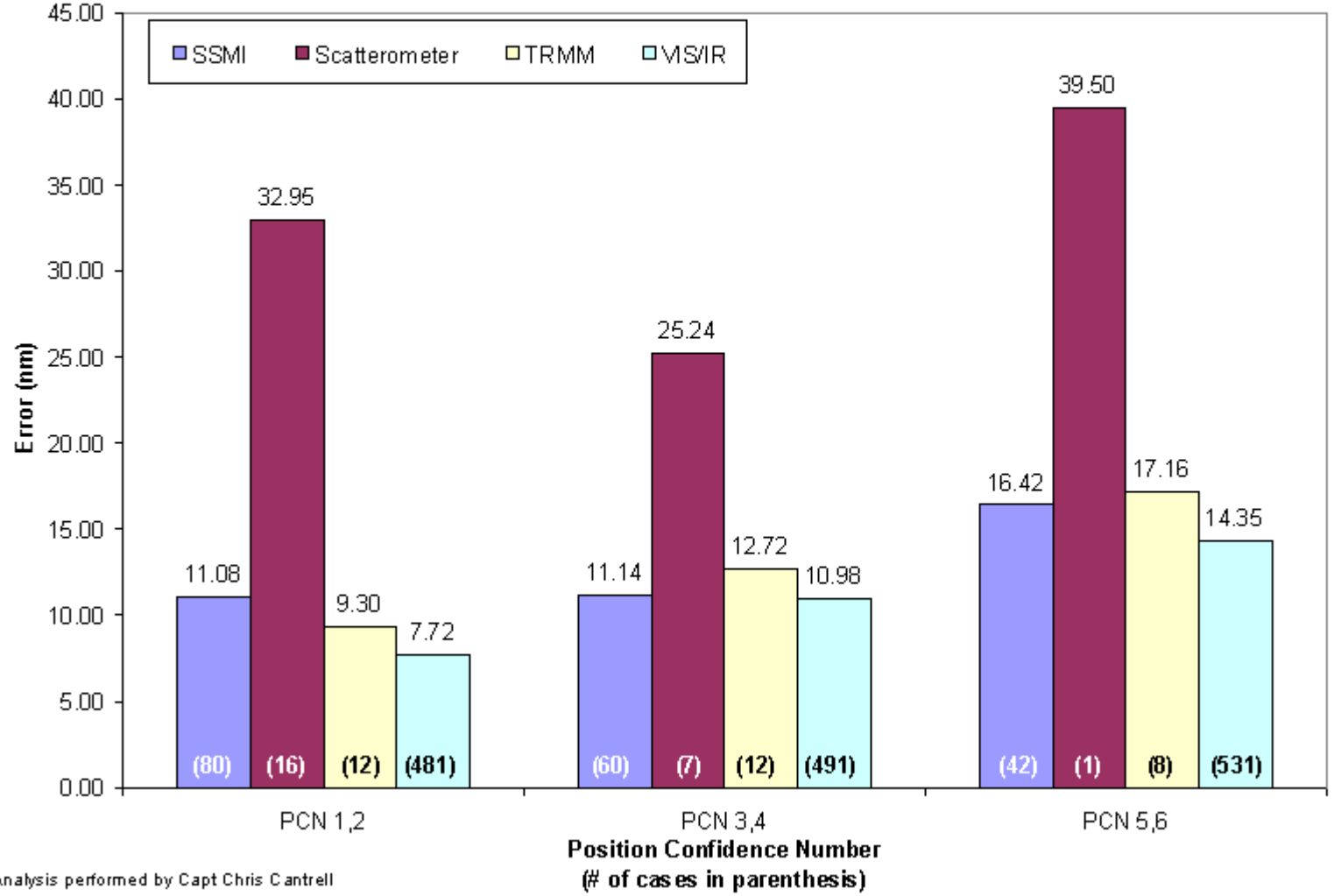
30
35
40
45

2000 Western North Pacific Fix Errors
Tropical Depression Strength



Analysis performed by Capt Chris Cantrell

2000 Western North Pacific Fix Errors
Typhoon Strength



Analysis performed by Capt Chris Cantrell

Capturing Rapidly-Evolving Rain Events

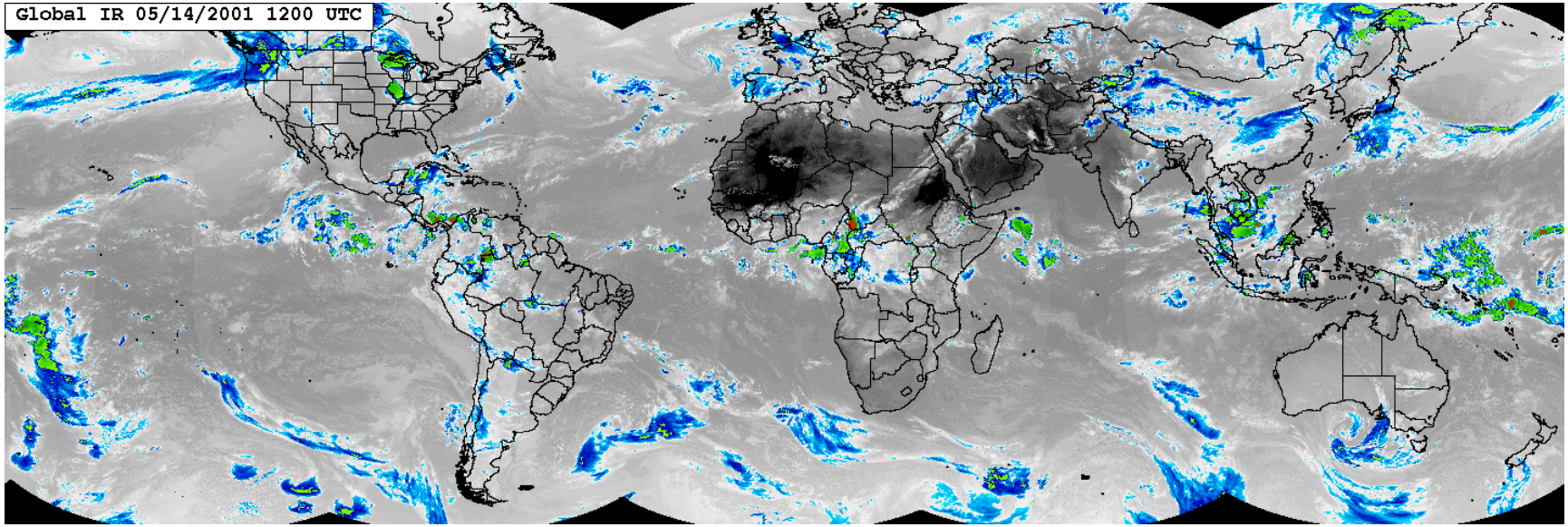
Basic Principle and Methodology

- GEO: rapid-update, fine-scale, IR-based
- LEO: infrequent time-update, coarse scale, microwave-based
- Accumulate regional probability-matched histograms of time/space-coincident IR and rain measurements, dynamically

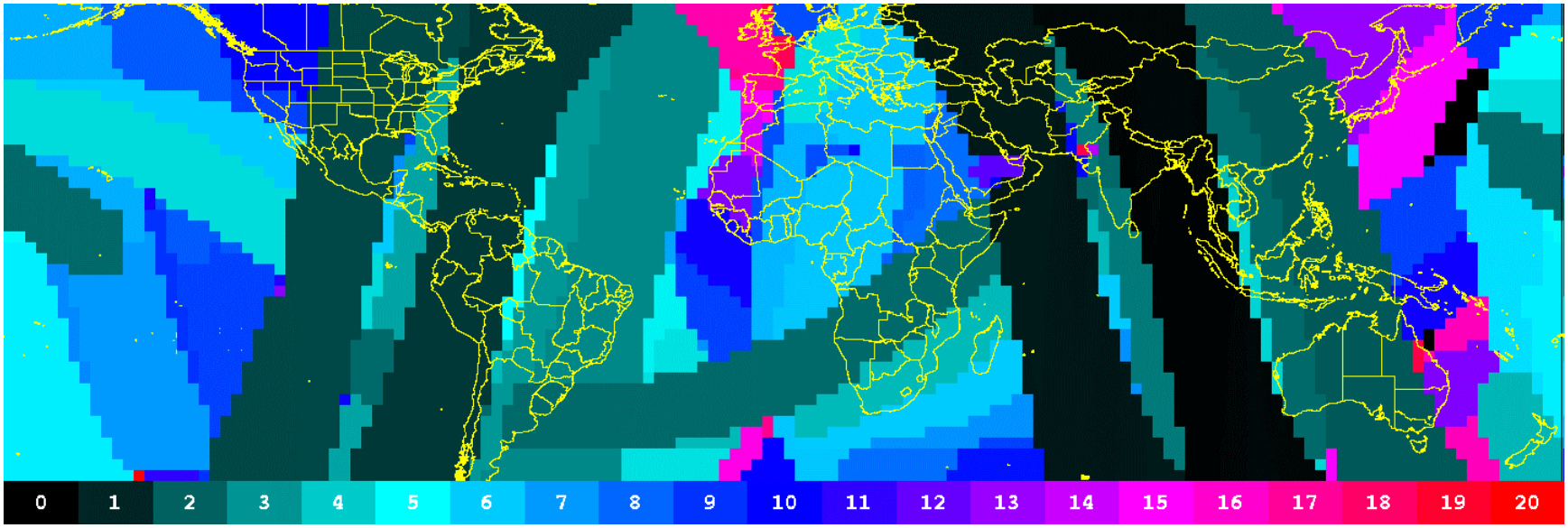
Limitations

- The limited number of MW-based satellite sensors
- At shorter time scales, the temporal information is nearly all from the IR
- Time gaps between successive microwave overpasses relative to the time scale of the storm evolution
- Orographically-based events
- Artifacts in the microwave data (snow, poor geolocation, etc.)

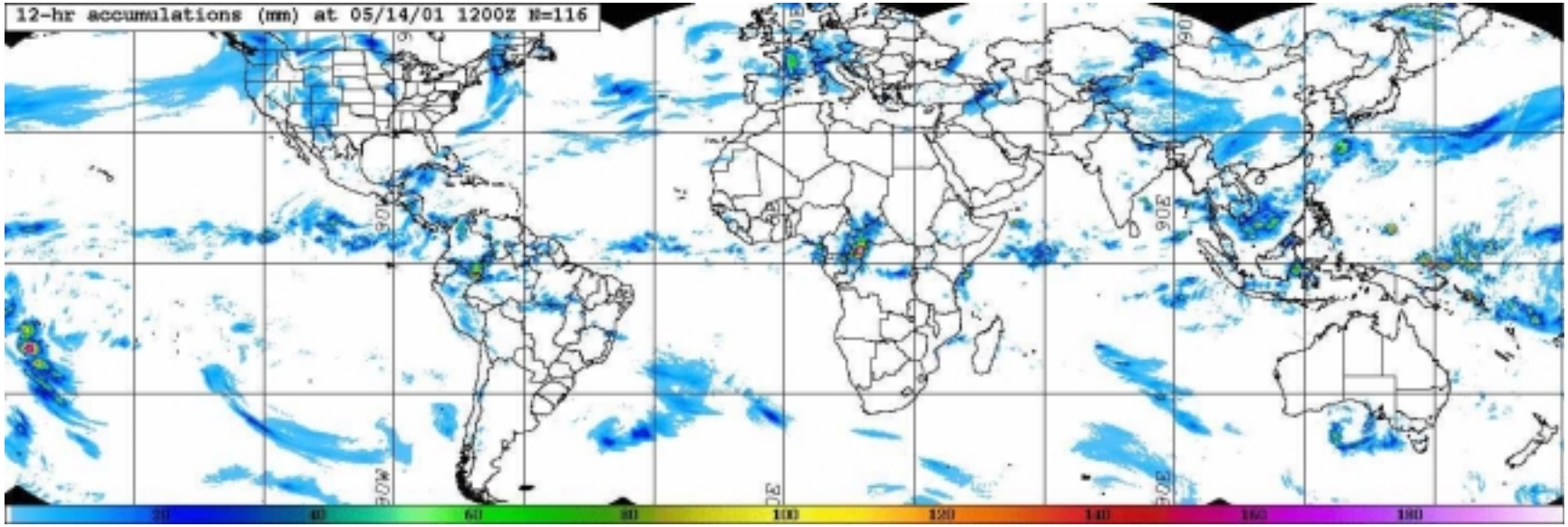
Global geostationary IR composite at 2001/05/14 1200 UTC



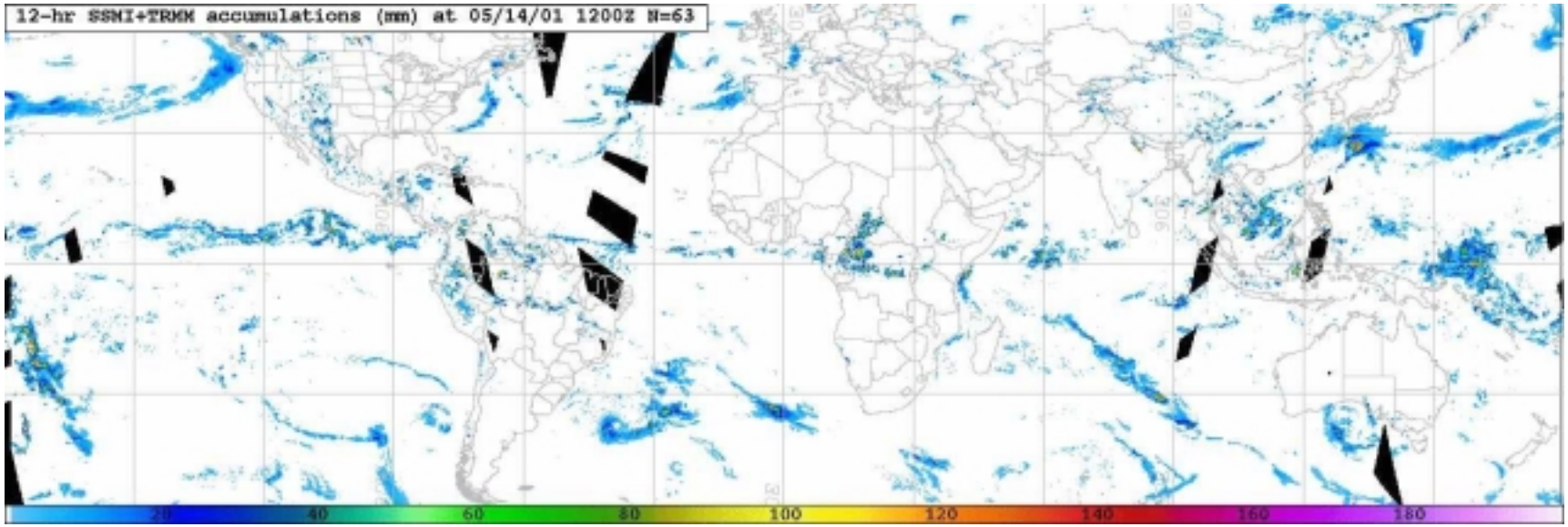
How many hours ago did the last microwave-based update occur? (F-13/14/15, TMI)



12-hour accumulations at 2001/05/14 1200 UTC – **blended technique**



12-hour accumulations at 2001/05/14 1200 UTC – **microwave only** (F-13/14/15, TMI)



Research Activities and Plans

Precipitation Validation

- Korean Peninsula (1-minute reporting gauge dataset)
- Australian national network (daily totals)
- Comparisons with other geostationary-based techniques

New Data Sources

- Currently investigating the addition of AMSU data to increase the frequency of microwave-based overpasses
- Additional use of NWP model data to “smarten” the blended satellite rain technique

NWP Applications

Cloud LWC data assimilation (2003-2004 time frame)